

### *Claims*

What is claimed is:

1. A method of making a macroporous titania opals film on a substrate, comprising the steps of:
  - a) Preparing a diluted solution of Titanium alkoxides precursor in anhydrous ethanol;
  - b) Dropping a polystyrene colloidal crystal template film on substrate vertically into a Falcon tube half-filled with said solution;
  - c) Circulating Falcon tube using a centrifuge instrument;
  - d) Removing said film from said Falcon tube and placing said film in a loosely closed container to slowly hydrolyze Titanium alkoxide sol inside said template;
  - e) Repeat said steps b to d for 5 to 7 times to fill the voids of said film;
  - f) Heating the hydrolyzed said film to calcine amorphous titania and convert said titania to anatase or rutile format and, in the process, gasify and burn the polystyrene template.
2. The method as specified in claim 1 wherein said polystyrene colloids are surfactant stabilized with sulfate functional group.
3. The method as specified in claim 1 wherein the precursor compound comprises Titanium Isopropoxide (TiPT) or Titanium ethoxide (TEOT).
4. The method as specified in claim 1 wherein the concentration of said precursor alkoxide (TiPT or TEOT) is between 0.8 V% and 4 V%.
5. The method as specified in claim 1 wherein said centrifuge rotating speed is between 1200 rpm to 3600 rpm.
6. The method as specified in claim 1 wherein said centrifuge instrument ran for 30 minutes to an hour.
7. The method as specified in claim 1 wherein the infiltrated template when removed from the Falcon tube and placed said film in a loosely closed container to slowly hydrolyze Titanium alkoxide said sol inside the template for 3 to 6 hours.
8. The method as specified in claim 1 wherein said heating was done in a tube furnace under airflow and was controlled as follows:
  - a) Temperature was increased from room temperature (25°C) to 80°C at a rate of 0.46 °C/min;
  - b) Temperature stayed at 80°C for an hour;
  - c) Temperature was increased from 80°C to 450°C at a rate of 2.06°C/min;
  - d) Temperature remained at 450°C for 3 hours;
  - e) The furnace was turned off and let said film to cool down to room temperature.